Operator Manual

Cummins **Onan**

Performance you rely on.™

Commercial Mobile Generator Set

HDKBB (Spec A–F)
HDKBC (Spec D–F)

English – Original Instructions 2–2010 981–0183 (Issue 3)

California

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING ⚠

Do not use this genset on a boat
Such use may violate U. S. Coast Guard regulations and can result in severe personal injury or death from fire, electrocution, or carbon monoxide poisoning

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SAFETY PRECAUTIONS

Thoroughly read the OPERATOR'S MANUAL before operating the genset. Safe operation and top performance can only be obtained when equipment is properly operated and maintained.

Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards shall remove, dismantle and dispose of the generator set. See service manual.

Some generator set installation procedures present hazards that can result in severe personal injury or death. Only trained and experienced personnel with knowledge of fuels, electricity, and machinery hazards should perform generator set installation procedures

The following symbols in this manual alert you to potential hazards to the operator, service person and equipment.

⚠ DANGER ***Used to alert you to a lethal hazard against which you must take steps to prevent severe personal injury or death, as when you are in the vicinity of High Voltage equipment.***

⚠WARNING ***Used to alert you to a hazard or unsafe practice that can result in severe personal injury or death.***

⚠ CAUTION ***Used to alert you to a hazard or unsafe practice that can result in personal injury or equipment damage.***

Electricity, fuel, exhaust, moving parts and batteries present hazards which can result in severe personal injury or death.

ENGINE EXHAUST IS DEADLY

- Inspect for exhaust leaks at every startup and after every eight hours of running.
- Learn the symptoms of carbon monoxide poisoning in the genset Operator's Manual.
- Never sleep in the vehicle while the genset is running unless the vehicle is equipped with a working carbon monoxide detector.
- Do not operate the genset when the vehicle is parked in a confined space, such as a garage.
- Disable the automatic genset starting feature (AGS) of an inverter-charger or other automatic starting device before storing the vehicle or parking it in a garage or other confined space.
- The exhaust system must be installed in accordance with the genset Installation Manual.
- Engine cooling air must not be used for heating the vehicle.

GENERATOR VOLTAGE IS DEADLY

- Disable the automatic genset starting feature (AGS) of an inverter-charger or other automatic starting device before servicing the genset.
- Generator electrical output connections must be made by a trained and experienced electrician in accordance with applicable codes.

⚠WARNING ***Interconnecting the generator set and shore power can lead to electrocution or utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections.***

- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry, stand on a dry wooden platform or rubber insulating mat and use tools with insulated handles.

DIESEL FUEL IS COMBUSTIBLE

- Do not smoke or turn electrical switches ON or OFF where fuel fumes are present or in areas sharing ventilation with fuel tanks or equipment. Keep flames, sparks, pilot lights, arc-producing equipment and all other sources of ignition well away.
- Fuel lines must be secured, free of leaks and separated or shielded from electrical wiring.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disable the automatic genset starting feature (AGS) of an inverter-charger or other automatic starting device before servicing the genset.
- Do not wear loose clothing or jewelry near moving parts such as PTO shafts, fans, belts and pulleys.
- Keep hands away from moving parts.
- Keep guards in place over fans, belts, pulleys, and other moving parts.

BATTERY GAS IS EXPLOSIVE

- Wear splash−proof safety glasses.
- Do not smoke or permit flames or sparks to occur near the battery at any time.
- To reduce arcing when disconnecting or reconnecting battery cables, always disconnect the negative (−) battery cable first and reconnect it last.

FLAMMABLE VAPOR CAN CAUSE A DIESEL ENGINE TO OVERSPEED

⚠WARNING ***Do not operate a diesel-powered genset where a flammable vapor environment can be created by fuel spill, leak, etc.***

Flammable vapor can cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. The owners and operators of the genset are solely responsible for operating the genset safely.

GENERAL PRECAUTIONS

- Keep children away from the genset.
- Do not use evaporative starting fluids. They are highly explosive.
- To prevent accidental or remote starting while working on the genset, disconnect the negative (−) battery cable at the battery.
- Keep the genset and its compartment clean. Excess oil and oily rags can catch fire. Dirt and gear stowed in the compartment can restrict cooling air.
- Make sure all fasteners are secure and torqued properly.
- Do not work on the genset when mentally or physically fatigued or after consuming alcohol or drugs.
- Used engine oil has been identified by some U. S. state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.
- Ethylene glycol, used as engine antifreeze, is toxic to humans and animals. Clean up spills and dispose of used engine coolant in accordance with local environmental regulations.
- Keep multi-purpose fire extinguishers handy. Multi−purpose fire extinguishes are used for fires that involve ordinary combustible materials such as wood and cloth; combustible and flammable liquid fuel and gaseous fuels; live electrical equipment. (North America or US: ref. NFPA No. 10)
- Genset installation and operation must comply with all applicable local, state and federal codes and regulations.
- Generator sets with a sound shield shall not be run with the service doors remove/missing.
- Engine components can be hot and cause severe burns. Hot coolant under pressure can spray and cause severe burns.
- Use personal protective equipment when performing periodic maintenance operations such as gloves, safety glasses, etc.

THE HAZARDS OF CARBON MONOXIDE

⚠WARNING ***Engine−driven generators can produce harmful level of carbon monoxide that can injury or kill you.***

ONLY YOU CAN PROTECT YOURSELF FROM CO POISONING!

- Watch constantly for people near the exhaust of the generator set while it is running.
- Make sure exhaust cannot enter the living quarters through a window, vent or door.
- Make sure all CO detectors or audible alarms are working properly.
- Pay attention to the signs of CO poisoning.
- Check the exhaust system for corrosion, obstruction and leaks each time you start the generator set and every eight hours if you run it continuously.

SUBSTANCE HAZARDOUS TO HEALTH

Generator sets use substances, and emit and create wastes that can cause health risks. Generator set operators must use appropriate personal protective equipment (such as clothing, gloves, protective glasses/goggles, and respiration equipment) when exposed to fuel, oil, coolant, wet batteries, grease, cleaning agents, or other substances exposed to lungs, eyes, or skin. use appropriate containers for transport, storage, and disposal of waste substances. Follow local regulations for disposal and recycling.

ANTIFREEZE (FLEETGUARD – ES COMPLEAT/EG PREMIX)

This antifreeze is also know as an ethylene glycol based coolant; summer coolant; coolant additive. It is purple coloured, viscous liquid, with a mild chemical odour, is soluble in water and harmful. It contains ethylene glycol, and diethylene glycol. Ethylene glycol is a potentially hazardous constituent.

The substance has a boiling point of 107° C, and a flash point of 121° C.

It is used as an engine coolant additive, and can be found in engine cooling systems, and head exchangers. Installers, operators and maintainers are likely to encounter this substance.

HAZARDOUS REACTIONS

Ethylene glycol is combustible when exposed to heat or flame and can react vigorously with oxidants. Moderate explosive hazard in form of vapour when exposed to heat or flame. Hazardous products resulting from combustion or decomposition include carbon monoxide, carbon dioxide and acrid smoke. Self–contained breathing apparatus must be worn in the event of fume build up.

Avoid strong oxidizing agents – incompatible with sulfuric acid, nitric acid, caustics and aliphatic amines.

It may cause neurological signs and symptoms, and kidney damage. It is also a skin and eye irritant.

Very toxic in particulate form upon inhalation. Harmful if swallowed, lethal dose for humans reported to be 100ml.

PROTECTIVE MEASURES

Refrain from eating, drinking or smoking when using the product. Adopt a high standard of personal hygiene. In case of skin contact, wash immediately with soap and water.

Ensure good ventilation and avoid heat sources. Avoid breathing mist, if there is a risk of vapour, or particulate, use a suitable organic vapour mask.

Eye protection, gloves, overalls, impervious apron should be used. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

STORAGE/TRANSPORT

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight, away for naked flames and strong acids, do not freeze. Store well away from food–stuffs and drinking water. Take special care to avoid discharge into drains, sewers and water–courses.

Contain leak/spill with sand, earth or non–combustible, absorbent material to prevent entry of substance into drainage/sewerage system, water–courses and land. Eliminate all ignition sources, use plastic shovel to transfer to suitable container and dispose of unwanted or absorbed substance through and authorized contractor to a licensed site.

EMERGENCY ACTION

- Fire
  Extinguishing media: CO_2, alcohol resistant foam, dry powder, or water spray.
  Fire fighters to use self contained breathing apparatus. Keep fire exposed containers cool. Prevent run–off from entering waterways, drains and drinking water supplies.
- Ingestion
  Toxic by ingestion. If swallowed induce vomiting only under the advice of a Doctor or poison control centre. Delayed treatment may result in fatality.
- Inhalation (of vapour)
  Remove from further exposure. In case of irritation to lungs or throat, seek medical advice.
- Aspiration (inhalation of liquid)
  Obtain immediate medical assistance.
- Eyes
  Flush copiously with water or preferably eye–

wash solution for at least five minutes. Seek medical advice.

- Skin
  Wash thoroughly with soap and water, and seek medical attention if irritation develops. Change clothing if necessary and wash before re–use.
- Spillage
  Soak–up using an absorbent material and dispose of this as directed under Storage/Transport (Section 5.1.3)

GAS OIL

This product is also known as Red Diesel, Fuel Oil, and type A1 or A2. It can be pale red or a clear liquid with a characteristic mild odour. It contains catalytically cracked oil, petroleum distillates, quinizarin, and gas oil maker dye red. The catalytically cracked oil and petroleum distillates are potentially hazardous constituents.

The substance has an initial boiling point of 180°C, a flash point greater than 56°C, and a vapour pressure less than 0.7mm Hg at 20°C and has negligible solubility in water.

It is used as a fuel for off–road diesel powered vehicles and stationary engines, and can be found in fuel tanks, pipes and injection systems. The substance should not be used for any other purpose without contacting the manufacturer or supplier. Installers, operators and maintainers are likely to encounter this substance.

HAZARDOUS REACTIONS

This liquid is flammable. Avoid smoking, heat sources, such as welding and naked flames, sparks and static electricity build–up. Thermal decomposition products are hazardous, containing CO_X, NO_X and SO_X compounds.

The vapour is explosive. High vapour concentrations can cause respiratory irritation, dizziness, nausea, and loss of consciousness. Excessive and prolonged exposure to the mist can cause chronic inflammatory reaction of the lungs and form of pulmonary fibrosis.

Avoid strong oxidising agents, e.g. chlorates which may be use in agriculture.

Gas oil is slightly irritating to the skin and has a de–fatting action. Toxicity following single exposure to high level of gas oil is of low order. Prolonged, repeated skin contact may de–fat the skin resulting in possible skin irritation and dermatitis. In some cases warty, cancerous growths have occurred.

PROTECTIVE MEASURES

Ensure good ventilation and avoid heat sources. Observance of good housekeeping rules will ensure general safety. Do not smoke. Avoid breathing mist.

When working on, or testing, injection equipment, special care is required to avoid perforation of skin by high pressure fuel. Use eye protection in the event of suspected high pressure leak.

Adopt a high standard of personal hygiene. In the case of skin contact, wash well with soap and water.

Use glove and overalls, and eye protection goggles if there is a risk of splashing. Use oil impervious gloves and avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly. Contaminated clothing should be removed, soaked with water, and laundered before re–use.

No special respiratory precautions are necessary in normal use.

DO NOT use as a solvent for removing dirt/grease etc, from skin.

STORAGE/TRANSPORT

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight and away from naked flames. Electrical continuity is required between the transport and storage vessels during product transfer.

Contain leak/spill with sand, earth or other suitable material, and prevent entry of substance into drainage/sewerage system, water–courses and land. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

Inform local and fire authorities should the product reach waterways, drains etc.

EMERGENCY ACTION

- Fire
  Extinguishing media:
  Large fire – Foam/water fog. Never use water jet.
  Small fire – foam/dry powder, AAAF, CO_2, sand, earth.
  Avoid making sparks. Fire fighters to use self–contained breathing apparatus. Keep fire exposed containers cool, using water fog/spray. Prevent run–off from entering waterway, drains and drinking water supplies.
- Ingestion
  Do not induce vomiting. Wash the mouth out with water, and send to hospital immediately.
- Inhalation (of vapour)
  Remove from further exposure. Obtain medical assistance immediately.
- Aspiration (inhalation of liquid)
  If, following ingestion of gas oil, vomiting occurs, there is danger of aspiration into the lungs. This would cause intense local irritation and chemical pneumonitis that can be fatal. Obtain immediate medical assistance.
- Eyes
  Irrigate copiously with water or preferably eye–wash solution for at least five minutes. If irritation persists seek medical advice.
- Skin
  Wash thoroughly with soap and water. Change clothing if necessary.
  If high pressure injection has occurred prompt surgical attention is required.
- Spillage
  Absorb using sand, earth or other suitable material. Dispose of unwanted or absorbed flammable material as directed under Storage/ Transport (Section 5.7.3).

LUBRICATION OIL – PREMIUM BLUE E 15W40

Also known as oil, lube oil, sump oil, new oil is dark, viscous liquid with a slight, characteristic odour. The base oil contains: distillates (petroleum), solvent–dewaxed heavy paraffinic. It is not classified as dangerous according to Directive 1999/45/EC and its amendments, and is not classified according to the EU regulations.

It has a boiling point greater than 150°C, a flash point Open Cup of 220°C (Cleveland), and is insoluble in cold water.

It is used in engine lubricant oil systems, sump pan and filters, make–up tanks and piping systems as a lubrication oil for use in wide range of diesel engines operating under severe conditions. Installers, operators and maintainers are likely to encounter this product.

HAZARDOUS REACTIONS

This product is stable although slightly re–active with oxidising agents. Results of decomposition are carbon oxides (CO, CO_2) and water.

Although harmful if swallowed or aspirated (breathed in), repeated or prolonged exposure is not known to aggravate medical conditions.

Used oil may contain harmful combustion by–products and unburnt fuel that will cause skin reactions as detailed for fuel. Particular care must be taken if oil form a severely overheated engine is handled – use impervious gloves, lab coat and safety glasses.

Do not breathe vapour/spray.

PROTECTIVE MEASURES

Ensure good ventilation and avoid heat sources.

Adopt a high standard of personal hygiene. In case of skin contact, wash thoroughly with soap and water.

Use safety glasses, impervious gloves and lab coat. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

No special respiratory precautions are necessary n normal use. Do no breathe vapour/spray when handling hot materials.

STORAGE/TRANSPORT

Store and transport only in correctly marked containers. Keep containers tightly sealed when not in use. Keep in a cool, well ventilated area, out of sunlight and away from naked flames. Store well away from food–stuffs and drinking water.

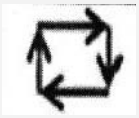
Wear splash goggles, full suit, boots and gloves. Absorb leak/spill with an inert material and dispose of unwanted or absorbed substance through an authorized contractor to a licensed site. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

EMERGENCY ACTION

- Fire
  Extinguishing media:
  Large fire – Use water spray, fog or foam. Do not use water jet.
  Small fire – Use dry chemical powder or CO_2
  Fire–fighters to use self contained breathing apparatus and full turnout gear. Keep fire exposed containers cool.
- Ingestion
  Do not induce vomiting, Obtain medical advice immediately.
- Inhalation (of vapour)
  Remove from further exposure. Obtain medical attention.
- Aspiration (inhalation of liquid)
  Obtain immediate medical assistance.
- Eyes
  Flush copiously with water or preferably eye–wash solution for at least fifteen minutes. Obtain medical advice.
- Skin
  Wash thoroughly with soap and water. Obtain medical advice if irritation develops. Change clothing if necessary and wash before re–use.
- Spillage
  Absorb with an inert material and dispose of this as directed under Storage/Transport.

Generator Set Warning Labels

Warning signs are provided on the generator set at or near the point of risk. To avoid injury, always take the necessary precautions – as indicated on the sample signs shown below:

	Caution / Warning. Indicates a risk of personal injury.
	Caution / Warning of Temperature Hazard. Indicates a risk of personal injury from high temperature.
	Caution / Warning of High Voltage Hazard. Indicates a risk of personal injury from electric shock/electrocution.
	Caution / Warning. Indicates a risk of personal injury from equipment that may be subject to automatic starting or remote starting.
	Caution / Warning. Indicates to read Operator manual for additional information.
	Caution / Warning of Belt and Rotating Part Hazard. Indicates a risk of personal injury from entanglement in moving parts.
	Caution / Warning of Pressure Hazard. Indicates a risk of personal injury from pressurized fluids.

1.Introduction

ABOUT THIS MANUAL

This is the Operator Manual for the generator sets (gensets) listed on the front cover. Read and carefully observe all of the instructions and precautions in this manual. Keep this manual with the other vehicle manuals.

Operation, Periodic Maintenance and *Troubleshooting* provide the instructions necessary for operating the genset and maintaining it at top performance. The owner is responsible for performing maintenance in accordance with the PERIODIC MAINTENANCE SCHEDULE (Page 20).

⚠WARNING ***This genset is not a life support system. It can stop without warning. Children, persons with physical or mental limitations, and pets could suffer personal injury or death. A personal attendant, redundant power or an alarm system must be used if genset operation is critical.***

⚠WARNING ***This generator set is not "ignition protected" and shall not be used in a flammable vapor environment.***

⚠WARNING ***Improper service or replacement of parts can lead to severe personal injury or death and to damage to equipment and property. Service personnel must be qualified to perform electrical and mechanical service.***

Unauthorized modifications or replacement of fuel, exhaust, air intake or speed control system components that affect engine emissions are prohibited by law in the State of California.

MODEL IDENTIFICATION

Be ready to provide the genset model and serial numbers on the nameplate when contacting Cummins Onan for parts, service or information. Figure 1 illustrates the nameplate and its location. The gray boxes illustrate where to look for the model and serial numbers.

Record these numbers in the figure that they are easy to find when needed. Each character in these numbers is significant. The last character of the model number is the specification letter, which is important for obtaining the right parts. Genuine Cummins Onan replacement parts are recommended for best results. Refer to the genset Parts Catalog.

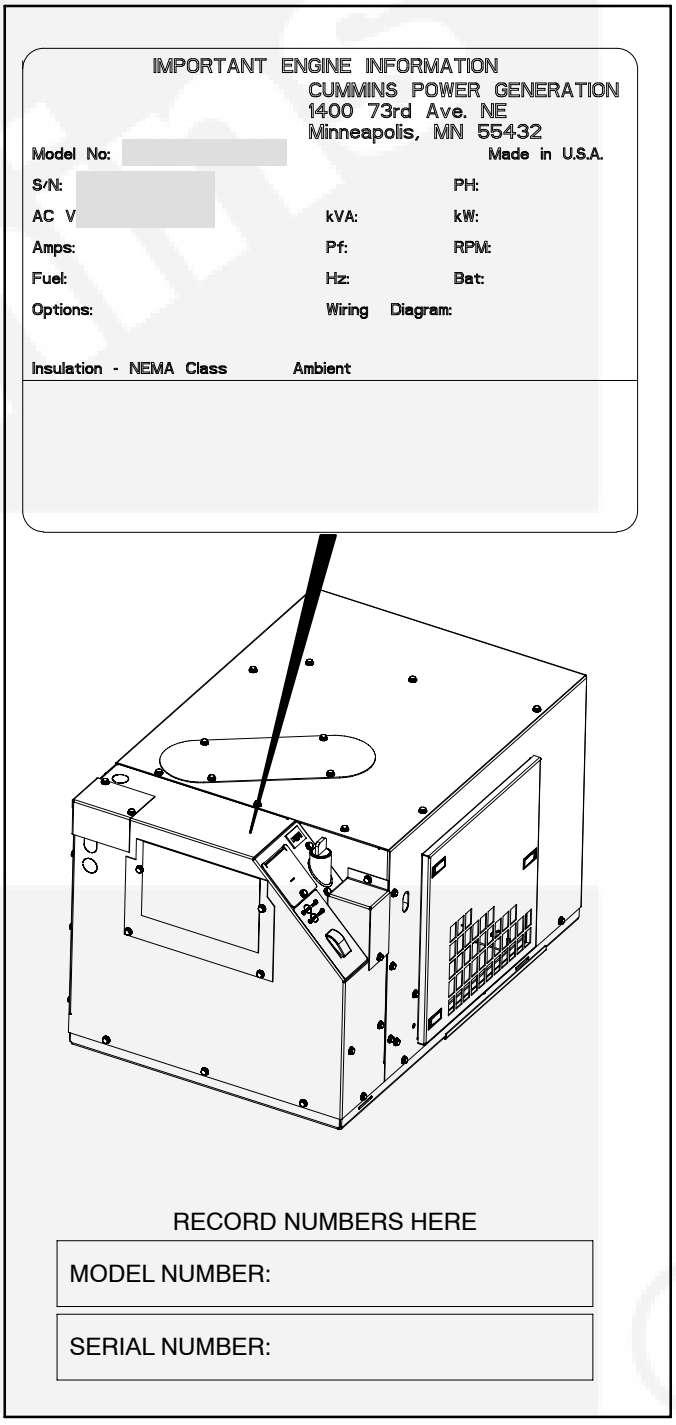


FIGURE 1. TYPICAL NAMEPLATE

NOISE

Generator sets emit noise. As noise level and time of exposure increase, risk of hearing damage increases. The Specifications page in the Operator manual states noise level for this generator set. Select and use personal hearing protection appropriate for your exposure to generator set noise.

Note for use in countries where compliance to the EU Noise directive is required: This generator set has not been evaluated and is not marked for use in open air. Install the generator set in accordance with the Installation manual. Obey local noise restrictions when you operate the generator set.

ELECTROMAGNETIC COMPATIBILITY

Generator sets emit and receive electromagnetic (radio frequency) energy. If the generator set affects operation of nearby devices, or nearby devices affect generator set operation, increase the distance between them.

Note for use in countries where compliance to the EMC directive is required: This generator set has been evaluated for use in residential, commercial, and light industrial environments.

ENGINE EMISSIONS COMPLIANCE

Labels that state compliance with applicable engine emissions regulations are located on the side of the engine valve cover and in the lower left hand corner on the front of the genset. Refer also to the FEDERAL EMISSION DESIGN AND DEFECT LIMITED WARRANTY FOR C. I. ENGINES (DIESELS) that was shipped in the same package as the Operator Manual.

FUEL RECOMMENDATIONS

⚠WARNING ***Diesel fuel is combustible and can cause severe personal injury or death. Do not smoke near fuel tanks or fuel-burning equipment or in areas sharing ventilation with such equipment. Keep flames, sparks, pilot flames, electrical arcs and switches and all other sources of ignition well away. Keep a multi-class ABC fire extinguisher handy.***

High quality diesel fuel is necessary for good performance and long engine life.

- The specifications for the type and sulfur content (ppm, % weight) of the diesel fuel used must comply with all emissions regulations applicable in the areas where the genset is to be operated.
- Diesel fuels meeting ASTM D975 or EN 590 specifications are recommended. Use Grade 1-D diesel fuel where ambient temperatures are below 14° F (–10° C). A minimum Fuel Cetane Rating of 45 is recommended. Where ambient temperatures are below –4 F (–20° C), or the elevation is above 5000 ft (1500 m), a minimum Cetane Rating of 50 is recommended.
- Current US EPA regulations for Non-Road engines limit diesel fuel sulfur content to a maximum of 500 ppm (0.05% weight). Therefore, use Grade 2-D S500 or 2-D S15 diesel fuel. Where ambient temperatures are below 14° F (–10° C), use Grade 1-D S500 or 1-D S15 diesel fuel. Note that beginning in year 2010, US EPA regulations for Non-Road engines will limit diesel fuel sulfur content to a maximum of 15 ppm (0.0015% weight).
- Do not use diesel fuel having a sulfur content greater than 10,000 ppm (1.0% weight).
- Diesel fuel must meet the ASTM D975 standard for lubricity and pass a minimum load level of 3100 grams as measured by ASTM D6078, or maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156–1.
- B5 Bio-Diesel fuel that meets industry specifications and quality is suitable for use with this genset.

ENGINE OIL RECOMMENDATIONS

Oil Performance Class

Use API (American Petroleum Institute) classified engine oils according to the following guidelines:

- **Emissions-Regulated Areas:** It is mandatory to use CF, CF–4, CG–4, CH–4 or CI–4 class oil with low sulfur fuel (sulfur content less than 500 ppm, 0.05% weight) or ultra low sulfur fuel (sulfur content less than 15 ppm, 0.0015% weight).
- **Non-Regulated Areas:** CF class oil is recommended when using high sulfur fuel—sulfur content between 500 ppm (0.05% weight) and 5000 ppm (0.5%weight). If CF–4, CG–4, CH–4 or CI–4 class oil is used, the oil and oil filter must be changed twice as often as specified in the PERIODIC MAINTENANCE SCHEDULE (Page 20).

- **Non-Regulated Areas:** Use CF, CF–4, CG–4, CH–4 or CI–4 class oil when using high sulfur fuel—sulfur content between 5000 ppm (0.5% weight) and 10,000 ppm (1.0% weight). The oil and oil filter must be changed twice as often as specified in the PERIODIC MAINTENANCE SCHEDULE (Page 20).

Oil Viscosity

Look for the SAE (Society of Automotive Engineers) viscosity grade. Referring to Figure 2, choose the viscosity grade appropriate for the ambient temperatures expected until the next scheduled oil change. Multi-grade oils such as SAE 15W-40 are recommended for year-round use.

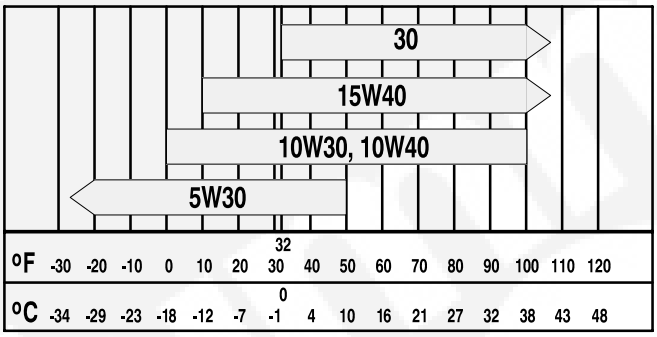


FIGURE 2. OIL VISCOSITY VS. TEMPERATURE

STARTING BATTERIES

The genset requires a 12 volt battery to power its control and starting circuits. Reliable genset starting and starter service life depend upon adequate battery system capacity and maintenance. See *Specifications* (Page 38) for battery requirements and MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 24) for battery care.

TYPICAL GENSET

Figure 3 illustrates a typical genset.

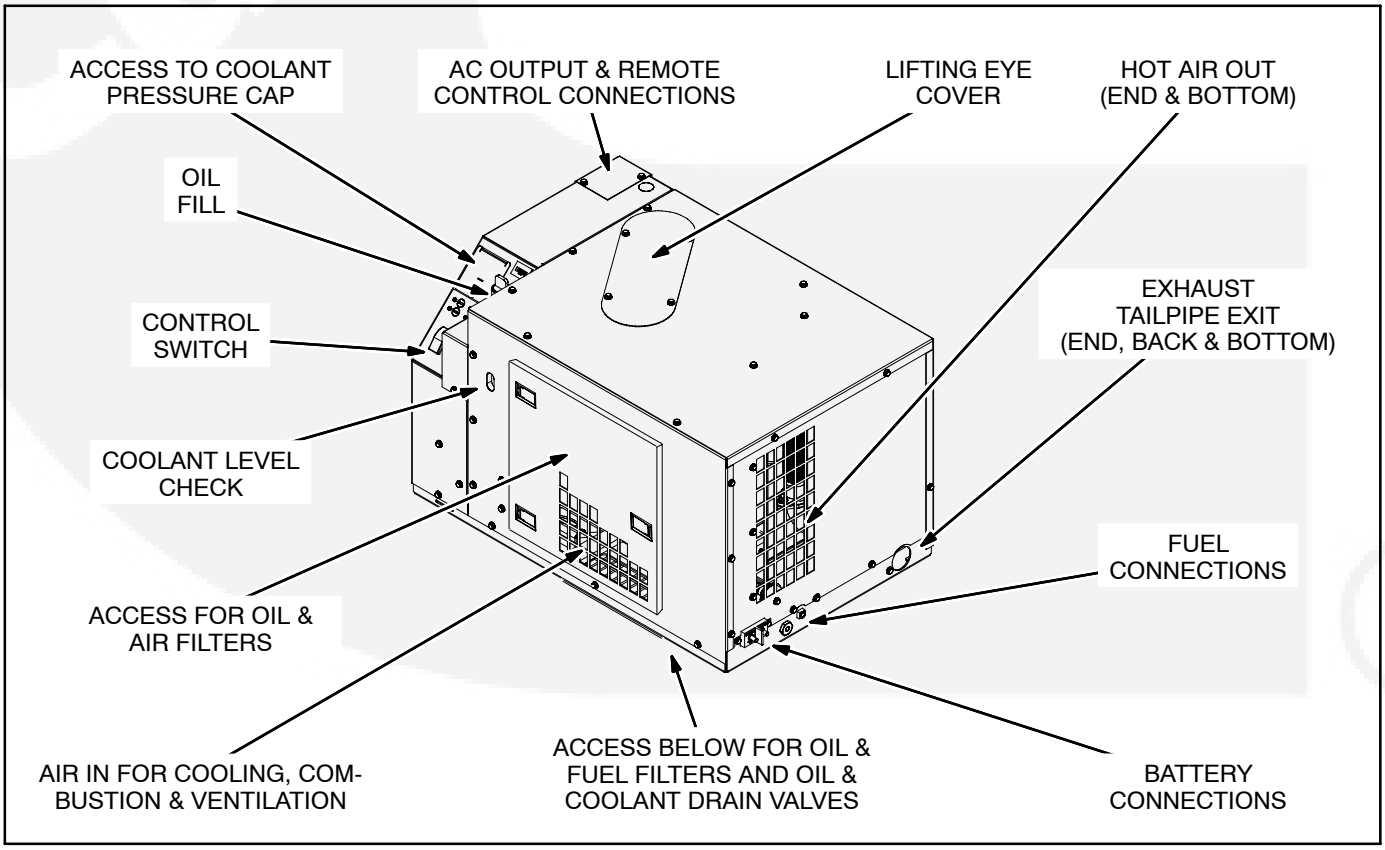

ACCESS TO COOLANT PRESSURE CAP
AC OUTPUT & REMOTE CONTROL CONNECTIONS
LIFTING EYE COVER
HOT AIR OUT (END & BOTTOM)
OIL FILL
CONTROL SWITCH
EXHAUST TAILPIPE EXIT (END, BACK & BOTTOM)
COOLANT LEVEL CHECK
FUEL CONNECTIONS
ACCESS FOR OIL & AIR FILTERS
AIR IN FOR COOLING, COMBUSTION & VENTILATION
ACCESS BELOW FOR OIL & FUEL FILTERS AND OIL & COOLANT DRAIN VALVES
BATTERY CONNECTIONS

FIGURE 3. TYPICAL GENSET

OPERATOR CONSOLE

The console (Figure 4) has the following features:

Control Switch

This switch is used to start and stop the genset, prime the engine fuel system and restore the fault code (blinking status light).

Status Light

This is an LED (light emitting diode) in the control switch which blinks rapidly during preheat and cranking. After the genset starts up, this light stays on continuously, indicating that the genset is running and that the starter has disconnected. If the genset shuts down, this light blinks in coded fashion to indicate the nature of the fault shutdown (see *Troubleshooting,* Page 30).

(Rapid blinking before cranking starts indicates that the glow plugs are preheating the combustion chambers. The controller automatically varies the time based on engine temperature.)

Line Circuit Breakers

The line circuit breakers protect the AC power leads connected to the genset.

Coolant Pressure Cap

The coolant pressure cap is under the access plate. Fill coolant here when refilling the system.

Coolant Recovery Tank

The recovery tank is mounted inside the genset and provides for coolant expansion. The coolant level is visible through the sight hole on the front of the genset. The fill cap is under the access cover. Replenish the normal loss of coolant here.

Oil Fill Cap and Dipstick

Check and fill engine oil.

REMOTE CONTROL PANEL

The vehicle probably has a control panel inside the vehicle for remote control of the genset. Cummins Onan offers three remote control kits as follows:

- Remote switch / status lamp
- Remote switch / status lamp and hour meter
- Remote switch / status lamp and DC voltmeter

The DC voltmeter indicates whether voltage across the 12 VDC control system and battery is normal. If the indicator consistently stays above or below the normal zone, see MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 24).

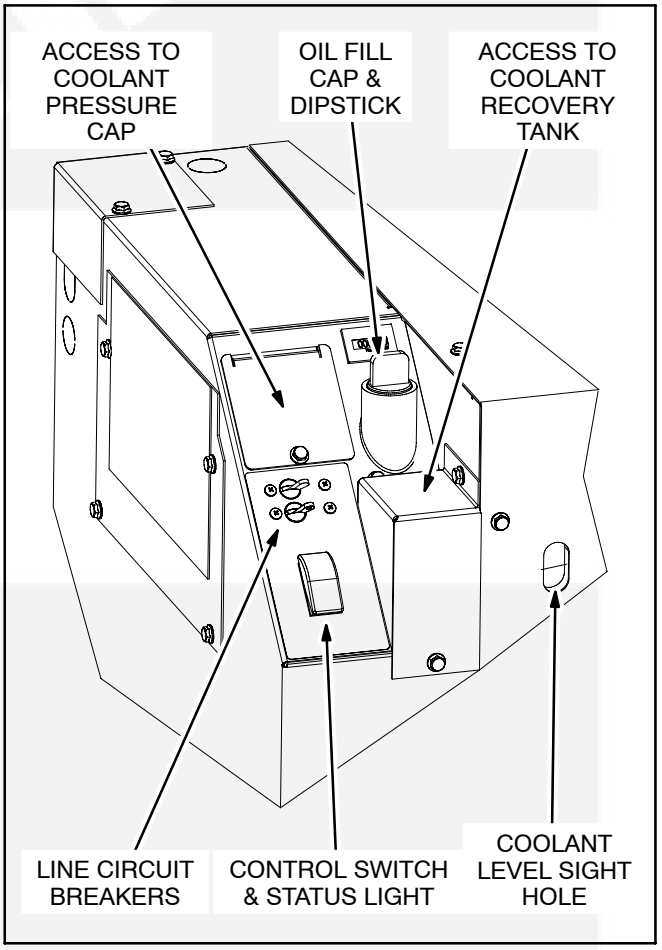

ACCESS TO COOLANT PRESSURE CAP
OIL FILL CAP & DIPSTICK
ACCESS TO COOLANT RECOVERY TANK
LINE CIRCUIT BREAKERS
CONTROL SWITCH & STATUS LIGHT
COOLANT LEVEL SIGHT HOLE

FIGURE 4. OPERATOR'S CONSOLE

BUILD STANDARDS

The generator set and its control system have been designed, constructed and tested generally in accordance with the following Standards where applicable refer to Table 1.

TABLE 1. BUILD STANDARDS

BS EN 1037:1995+A1:2008	Safety of machinery – Prevent of unexpected start up.
BS EN ISO 14121–1:2007	Safety of machinery. Risk assessment. Principles
BS EN ISO 13857:2008	Safety of machinery. Safety distance to prevent hazard zones being reached by upper and lower limbs.
BS EN 349:1993+a1:2008	Safety of machinery – Minimum gaps to avoid crushing parts on the human body.
BS EN 547–1: 1996+A1:2008	Safety of machinery – Human body dimensions – Part 1: Principles of determining the dimensions required for openings for whole body access into machinery.
BS EN 547–2:1996+A1:2008	Safety of machinery – Human body dimensions – Part 2: Principles for determining the dimensions required for access openings.
BS EN 547–3:1996+A1:2008	Safety of machinery – Human body dimensions – Part 3: Anthropomorphic data.
BS EN 60204–1:2006+A1:2009	Safety of machinery. Electrical equipment of machines. General requirements
BS EN 614–1:2006+A1:2009	Safety of machinery. Ergonomic design principles. Terminology and general principles
BS EN 953:1997+A1:2009	Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards.
BS EN ISO 12100–1:2003+A1:2009	Safety of machinery. Basic concepts, general principles for design. Basic terminology, methodology
BS EN ISO 12100–2:2003+A1:2009	Safety of machinery. Basic concepts, general principles for design. Technical principles
BS EN ISO 13732–1:2008	Ergonomics of the thermal environment. Methods for the assessment of human responses to contact with surfaces. Hot surfaces
BS EN ISO 13849–1:2008	Safety of machinery – Safety related parts of control systems
BS EN ISO 13850:2006	Safety of machinery – Emergency stop. Principles for design.
BS EN 61310–1:2008	Safety of machinery – Indication, marking and actuation – Part 1: Requirements for visual, auditory and tactile signals.
BS EN 61310–2:2008	Safety of machinery – Indication, marking and actuation – Part 2: Requirements for marking.
BS EN 61000–6–1:2007	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for residential, commercial and light–industrial environments

BS EN 61000–6–3:2007	Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light–industrial environments
BS EN 1299:1997+A1:2008	Mechanical vibration and shock – Vibration isolation of machines – Information for the application of source isolation
BS EN 1679–1:1998	Reciprocating internal combustion engines – Safety – Part 1: Compression ignition engines
BS EN 12601:2001	Reciprocating internal combustion engine driven generating sets – Safety

2.Operation

⚠WARNING ***EXHAUST GAS IS DEADLY! All engine exhaust contains carbon monoxide; an odorless, colorless, poisonous gas that can cause unconsciousness and death. Symptoms of carbon monoxide poisoning include:***

- ***Dizziness, Headache or Throbbing Temples***
- ***Weakness or Muscular Twitching***
- ***Sleepiness or Confusion***
- ***Nausea or Vomiting***

⚠WARNING ***IF YOU EXPERIENCE ANY OF THESE SYMPTOMS, GET INTO FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the genset and do not operate it until it has been inspected and repaired.***

⚠WARNING ***Never sleep in the vehicle while the genset is running unless the vehicle has a working carbon monoxide detector. The exhaust system must be installed in accordance with the genset Installation Manual. Make sure there is ample fresh air when operating the genset in a confined area.***

PRE-START CHECKS

Before the first start of the day and after every eight hours of operation, inspect the genset as instructed under CONDUCTING GENERAL INSPECTIONS (Page 14). Keep a log of maintenance and the hours run and perform any maintenance that may be due. See Returning the Genset to Service (Page 18) if the vehicle has been in storage.

Before each start:

1. Make sure all vehicle CO detectors are working.
2. Check for signs of fuel and exhaust leaks and damage to the exhaust system.
3. To prevent overheating and to reduce fouling with dust and debris, make sure the genset's normal ground clearance is not being reduced by sloping ground, curbs, logs or other objects. Repark the vehicle if necessary and/or remove any objects blocking the air inlet or air outlet.
4. Turn off air conditioners and other large equipment.

PRIMING THE FUEL SYSTEM

The fuel system should be primed after replacing the fuel filter or running the genset out of fuel. To prime the fuel system hold the control switch down in its **Stop** position for at least 1 minute (starts in 2 seconds).

STARTING THE GENSET

Start the genset from the genset control panel or remote control panel inside the vehicle.

⚠CAUTION ***Excessive cranking can overheat and damage the starter motor. Do not crank for more than 30 seconds at a time. Wait at least 2 minutes before trying again.***

1. Visually inspect for fuel, exhaust and coolant leaks. Do not start the genset if there is a fuel, exhaust or coolant leak and have it repaired.
2. Push and hold the switch at **START** until the genset starts. The status indicator light on the switch flashes during preheat and cranking. It will come on solid when the starter disconnects, indicating that the genset is running. (Depending on how cold it is, preheat can take up to 15 seconds, extending the time that the light blinks.)
3. See *Troubleshooting* (Page 30) if the genset does not start after several tries.
4. For top performance and engine life, especially in colder weather, let the engine warm up for two minutes before connecting loads.

STOPPING THE GENSET

Turn off air conditioners and other large loads and let the genset run for two minutes to cool down. Then push the switch to **STOP**.

AUTOMATIC STARTING AND STOPPING

The vehicle may be equipped with an inverter-charger or other automatic genset starting device (AGS). Always follow the instructions and safety precautions provided by the manufacturer of the automatic starting device when enabling automatic genset starting.

⚠WARNING ***EXHAUST GAS is deadly. MOVING PARTS and ELECTRICITY can cause severe personal injury or death. To reduce exposure to these hazards, always disable automatic genset starting before:***

- ***Sleeping, unless vehicle CO detector is enabled***
- ***Parking vehicle in garage or confined space***
- ***Parking vehicle for storage***
- ***Servicing genset***
- ***Servicing batteries***
- ***Servicing electrical appliances***
- ***Fueling vehicle***

LOADING THE GENSET

The genset can power AC motors, air conditioners, AC/DC converters and other loads. How much load* can be powered depends upon the genset power rating. The genset will shut down or its circuit breakers will trip if the sum of the loads exceeds genset power. See *Troubleshooting* (Page 30).

To avoid overloading the genset and causing shutdowns, compare the sum of the loads that are likely to be used at the same time to the power rating of the genset. ***It may be necessary to run fewer loads at the same time—the sum of the loads must not be greater than genset rating.***

Note that the genset may shut down due to overload when a large motor or air conditioner is started or cycles off and then on again, even though the sum of the loads is less than genset rating. The reason for this is that a motor's startup load is much larger than its running load. ***It may be necessary to run fewer loads when large motors and air conditioners are cycling on and off.***

Note also that maximum power decreases as altitude increases because air density decreases. For every 1000-foot (305 m) increase in elevation you can expect power to decrease approximately 3 percent. Table 2 shows the results of typical calculations. ***It may be necessary to run fewer loads at higher altitudes.***

TABLE 2. POWER VS. ALTITUDE

Elevation above Sea Level	Maximum Power
at/below 500 ft (152 m)	5000 W (rated)
at 2500 ft (762 m)	4700 W
at 5500 ft (1676 m)	4250 W
above 5500 ft (1676 m)	4250 W minus 150 W every 1000 ft (305 m)

CONNECTING TO UTILITY POWER

A vehicle with provisions for connecting utility power must have an approved device to keep the genset and utility from being interconnected. See the genset Installation Manual for more information.

⚠WARNING ***Interconnecting the genset and the public utility (or any other power source) can lead to electrocution of utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections.***

* Equipment load and genset power are measured in terms of watts (W) or kilowatts (kW), where 1 kilowatt (kW) = 1000 watts (W).

RESETTING CIRCUIT BREAKERS

If a circuit breaker in the main power distribution panel of the vehicle or on the genset (Figure 5) trips, either a circuit shorted or too many loads were running. Note that the genset will continue to run after a circuit breaker trips.

If a circuit breaker trips, disconnect or turn off as many loads as possible and reset the circuit breaker. (Push the circuit breaker to **OFF** to reset it and then to **ON** to reconnect the circuit.) If the circuit breaker trips right away, either the electrical distribution system has a short or the circuit breaker is faulty. Call a qualified electrician.

If the circuit breaker does not trip, reconnect the loads, one by one, up to a total load that does not overload the genset or cause the circuit breaker to trip. If a circuit breaker trips right away when an appliance is connected, the load equipment probably has a short.

Electrical equipment and tools must be used and maintained properly and be properly grounded to cause the line circuit breakers to trip when short circuits occur.

⚠WARNING ***Short circuits in electrical equipment and tools can cause fire and electrical shock leading to severe personal injury or death. Read and follow the equipment and tool manufacturer's instructions and warnings regarding use, maintenance and proper grounding.***

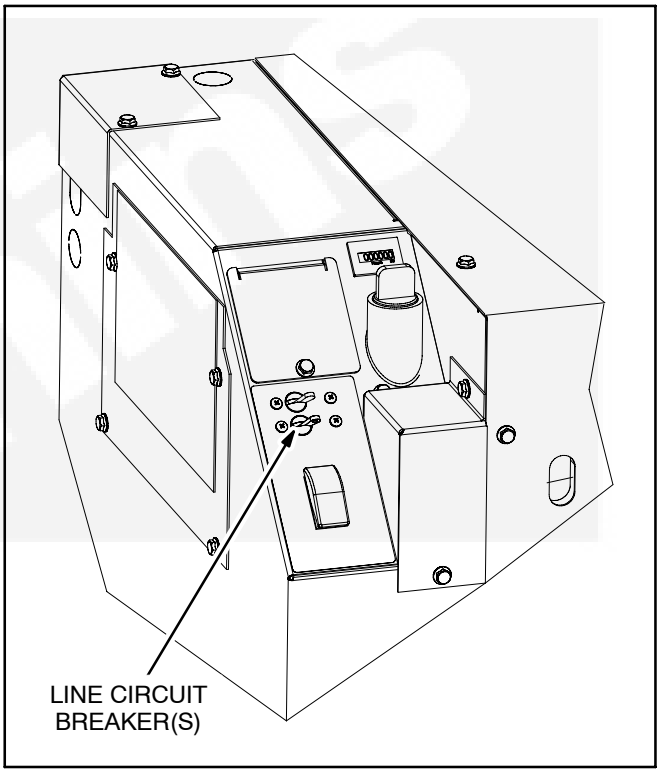


FIGURE 5. LINE CIRCUIT BREAKERS

OPERATING IN COLD WEATHER

Make sure the engine oil viscosity is appropriate for the cold weather temperatures. See ENGINE OIL RECOMMENDATIONS (Page 10). Be sure to change the oil if a sudden drop in temperature occurs.

OPERATING IN HOT WEATHER

Pay particular attention to the following items when operating the genset in hot weather:

1. Make sure nothing blocks airflow to and from the genset.
2. Make sure engine oil viscosity is appropriate for the ambient temperatures. See ENGINE OIL RECOMMENDATIONS (Page 9).
3. Keep the genset clean.
4. Perform maintenance due. See PERIODIC MAINTENANCE SCHEDULE (Page 20).

OPERATING AT HIGH ALTITUDE

For the effect of altitude on maximum power, see LOADING THE GENSET (Page 15).

OPERATING IN DUSTY ENVIRONMENTS

Pay particular attention to the following items when operating the genset in dusty environments:

1. Do not let dirt and debris accumulate inside the genset compartment. Keep the genset clean.
2. Perform air cleaner maintenance more often. See PERIODIC MAINTENANCE SCHEDULE (Page 20).
3. Change engine oil more often. See PERIODIC MAINTENANCE SCHEDULE (Page 20).
4. Keep containers of engine oil that have been opened tightly closed to keep out dust.

BREAKING IN A NEW ENGINE

Proper engine break-in on a new genset or on one with a rebuilt engine is essential for top engine performance and acceptable oil consumption. Run the genset at approximately 1/2 rated power for the first 2 hours and then at 3/4 rated power for 2 more hours.

Proper engine oil and oil level are especially critical during break-in because of the higher engine temperatures that can be expected. Change the oil if not appropriate for the ambient temperatures during break-in. See ENGINE OIL RECOMMENDATIONS (Page 9). Check oil level twice a day or every 4 hours during the first 24 hours of operation and change the oil and oil filter after the first 50 hours of operation.

EXERCISING THE GENSET

Exercise the genset at least 2 hours each month if use is infrequent. Run the genset at approximately 1/2 rated power. A single two hour exercise period is better than several shorter periods.

Exercising a genset drives off moisture, re-lubricates the engine, replaces stale fuel and removes oxides from electrical contacts. The result is better starting, more reliable operation and longer engine life.

STORING THE GENSET

Proper storage is essential for preserving top genset performance and reliability when the genset cannot be exercised regularly and will be idle for more than 120 days.

Storing the Genset

1. Push the genset line circuit breaker OFF (Page 16).
2. Change the engine oil and attach a tag indicating oil viscosity. See ENGINE OIL RECOMMENDATIONS (Page 9).
3. Disconnect the battery cables (negative [–] cable first) from the starting battery and store the battery according to the battery manufacturer's recommendations. See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 24).
4. Plug the exhaust tail pipe to keep out dirt, moisture, bugs, etc.
5. Close the fuel supply valve (if so equipped).

Returning the Genset to Service

1. Check the oil tag on the genset and change the oil if the viscosity indicated is not appropriate for the temperatures expected. See ENGINE OIL RECOMMENDATIONS (Page 9).
2. Reconnect the starting battery (negative [–] cable last). See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 24).
3. Remove the plug from the exhaust tailpipe.
4. Change the air filter element if it is dirty (Page 24).
5. Open the fuel supply valve (if so equipped).
6. Inspect the genset. See CONDUCTING GENERAL INSPECTIONS (Page 14).
7. Push the genset line circuit breaker ON (Page 16) when the genset is ready to power appliances.

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3.Periodic Maintenance

Periodic maintenance is essential for top performance and long genset life. Use Table 3 as a guide for normal periodic maintenance. In hot and dusty environments some maintenance procedures should be performed more frequently, as indicated by the footnotes in the table. Keeping a log of maintenance performed and hours run (Page 42) will help you keep genset maintenance regular and provide a basis for supporting warranty claims.

Maintenance, replacement or repair of emission control devices and systems may be performed by any engine repair establishment or individual. However, warranty work must be completed by an authorized Cummins Onan dealer.

TABLE 3. PERIODIC MAINTENANCE SCHEDULE

MAINTENANCE OPERATION	MAINTENANCE FREQUENCY						
	Every Day	After First 50 Hours	Every Month	Every 150 Hours	Every 500 Hours	Every 1000 Hours	Page
General Inspection	•						21
Check Engine Oil Level	•						22
Check Engine Coolant Level	•						28
Clean and Check Battery			•[2]				24
Clean Spark Arrestor				•[3, 7]			–
Change Engine Oil and Oil Filter		•		•[1, 2, 3, 4]			23
Replace Engine Air Filter					•[1, 3]		24
Replace Fuel Filter					•[3]		25
Check Coolant Anti-Freeze Protection					•[3]		21
Flush Coolant System						•[5]	21
Replace Coolant Pressure Cap						•[5]	21
Replace Engine V-belt (Coolant Pump)						•[6, 7]	–
Replace Coolant Hoses and Thermostat						•[6, 7]	–
Adjust Engine Valve Lash						•[6, 7]	–
Service Fuel Injectors						•[6, 7]	–
Check Generator Bearings, Drive Belt, Belt Tensioner & Drive Coupling						•[6, 7]	–

1 – Perform more often when operating in dusty conditions.
2 – Perform more often when operating in hot weather.
3 – Perform at least once a year.
4 – Perform every 75 hours when using high sulfur fuel. See ENGINE OIL RECOMMENDATIONS (Page 9).
5 – Perform at least once every two years.
6 – Perform at least once every five years.
7 – Must be performed by a qualified mechanic (authorized Cummins Onan dealer).

CONDUCTING GENERAL INSPECTIONS

Inspect the genset before the first start of the day and after every eight hours of operation.

Oil Level

Check engine oil level (Page 22).

Engine Coolant System

⚠CAUTION ***Operating the genset when coolant level is low can cause serious engine damage.***

Check the coolant level and look for coolant leaks around the bottom of the genset and on the ground below. Minor leaks that can be replenished by daily additions of coolant to the recovery tank should be repaired by a qualified service technician as soon as possible. Larger leaks are cause for shutting down the genset until it can be repaired.

Exhaust System

⚠WARNING ***EXHAUST GAS IS DEADLY! Do not operate the genset if there is an exhaust leak or any danger of exhaust gases entering or being drawn into the vehicle.***

Look and listen for exhaust system leaks while the genset is running. Shut down the genset if a leak is found and have it repaired before operating the genset again.

Look for openings or holes between the genset compartment and vehicle cab or living space if the genset engine sounds louder than usual. Have all such openings or holes closed off or sealed to prevent exhaust gases from entering the vehicle.

Replace dented, bent or severely rusted sections of the tailpipe and make sure the tailpipe extends at least 1 inch (25.4 mm) beyond the perimeter of the vehicle.

Check all CO monitors to assure proper operation.

⚠WARNING ***Do not park the vehicle in high grass or brush. Contact with the exhaust system can cause a fire.***

Park the vehicle so that the genset exhaust gases can disperse away from the vehicle. Barriers such as walls, snow banks, high grass and brush and other vehicles can cause exhaust gases to accumulate in and around the vehicle.

Do not operate power ventilators or exhaust fans while the vehicle is standing with the genset running. The ventilator or fan can draw exhaust gases into the vehicle.

Fuel System

Check for leaks at hose, tube and pipe fittings in the fuel supply system while the genset is running and while it is stopped. Check flexible fuel hose sections for cuts, cracks, and abrasions. Make sure the fuel line is not rubbing against other parts. Replace worn or damaged fuel line parts before leaks occur.

⚠WARNING ***Diesel fuel leaks can lead to fire. Do not operate the genset if operation causes fuel to leak.***

Prime the fuel system if the genset ran out of fuel.

Battery Connections

Check the battery terminals for clean, tight connections. Loose or corroded connections have high electrical resistance which makes starting harder. See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 24).

Mechanical

Visually inspect genset for mechanical damage. For generator sets with a sound shield, install service doors before running the generator set to listen for unusual noises. Check the genset mounting bolts. Check to see that the generator set air inlet and outlet openings are not clogged with debris or blocked. Keep the generator set compartment clean.

To prevent overheating and to reduce fouling with dust and debris, make sure the genset's normal ground clearance is not being reduced by sloping ground, curbs, logs or other objects. Repark the vehicle if necessary and/or remove any objects blocking the air inlet or air outlet.

CHECKING ENGINE OIL LEVEL

Park the vehicle on level ground and shut off the genset before checking engine oil level.

⚠WARNING ***State and federal agencies have determined that contact with used engine oil can cause cancer or reproduce toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin.***

⚠WARNING ***Crankcase pressure can blow hot engine oil out the fill opening causing severe burns. Always stop the genset before removing the oil fill plug or drain.***

⚠CAUTION ***Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the high and low beads on the dipstick.***

1. Pull the plug and dipstick out of the oil fill neck (Figure 6). The plug may be difficult to pull straight out. It is easier if you tilt the plug in its socket while pulling out. Wipe off the dipstick and thread it back into the fill neck and seat the plug, which snaps into its socket. Remove the plug and dipstick again and check the oil level on the dip stick.
2. Add or drain oil as necessary. See ENGINE OIL RECOMMENDATIONS (Page 9). Keep the oil level between the high and low beads on the end of the dipstick, as shown. It is not necessary to add oil between oil changes if the oil has not dropped more than 1/3 of the way between the high and low beads. Approximately 1 pint (0.4 liter) can be added if the oil level is at the lower bead.
3. Secure the oil fill plug, which snaps into its socket.

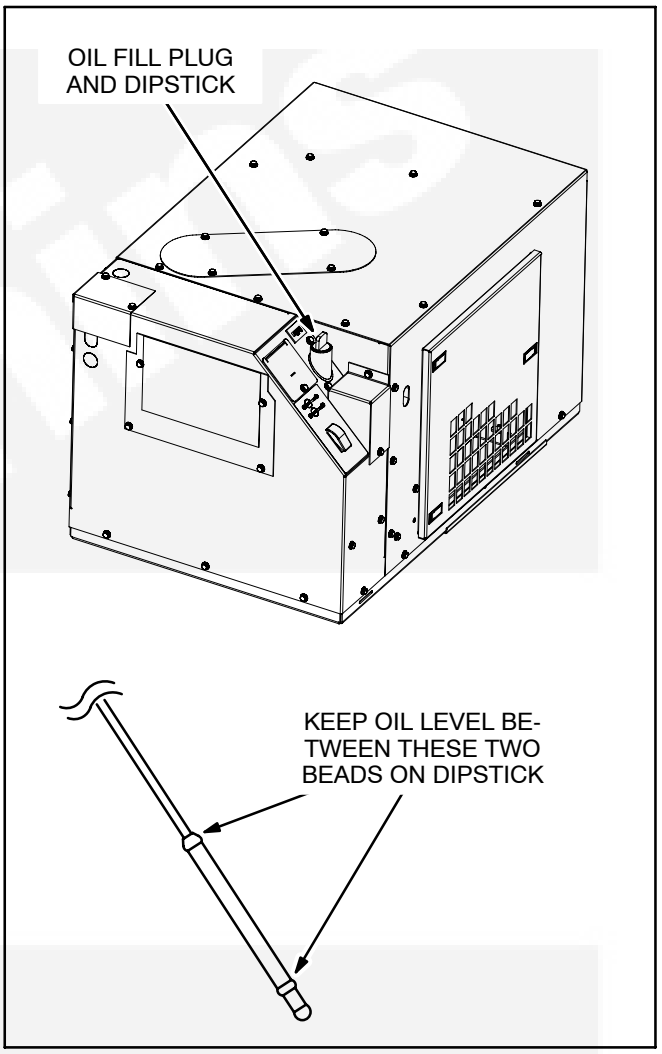

FIGURE 6. CHECKING ENGINE OIL LEVEL

CHANGING ENGINE OIL AND FILTER

Refer to Table 3 for scheduled engine oil change. Change oil more often in hot and dusty environments.

⚠WARNING ***State and federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin.***

⚠WARNING ***To prevent accidental or remote starting while working on the genset, disconnect the negative (–) battery cable at the battery.***

⚠WARNING ***Do not run the genset with the maintenance access covers off. Contact with hazardous moving parts and hot exhaust manifolds can cause severe personal injury.***

⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

1. Run the genset until warm and shut it off.
2. Pull the oil dipstick (Page 22) out a couple of inches (50 mm) so that the oil will drain faster.
3. Remove the front and bottom access covers (Figures 7 and 8) and direct the end of the drain hose into a container.
4. Open the drain valve to drain all of the old oil.
5. ***Close the drain valve***.
6. Spin off the oil filter and clean the filter mounting surface on the engine block. Remove the old gasket if it remains. (The oil filter is easier to remove through the front access opening.)
7. Make sure the gasket is in place on the new filter and apply a thin film of clean oil to the gasket. Spin the new filter on until the gasket just touches the block. Turn it an additional 1/2 to 3/4 turn. Do not over tighten.
8. Refill with 2 quarts (1.9 liters) of oil and check the level (Page 22).
9. Secure the maintenance access covers for proper engine cooling and for protection from hazardous moving parts and hot exhaust manifolds.
10. Dispose of the used oil and oil filter according to local environmental regulations.

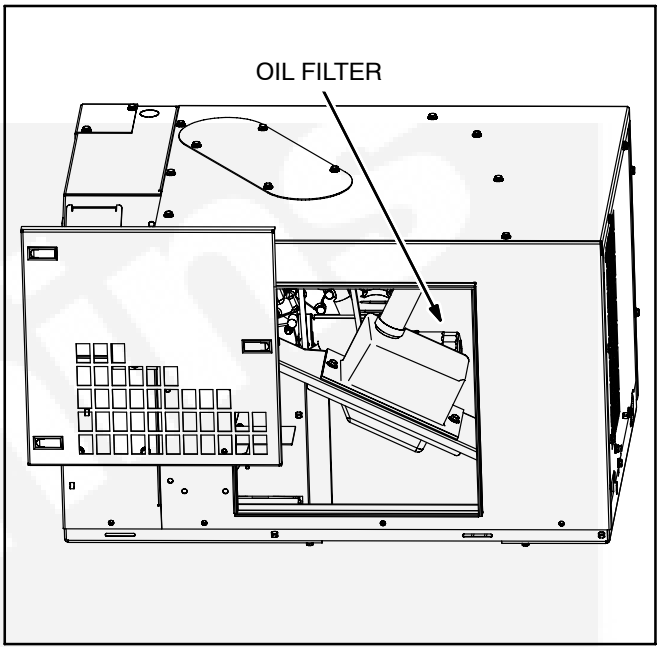

FIGURE 7. OIL FILTER ACCESS THROUGH FRONT

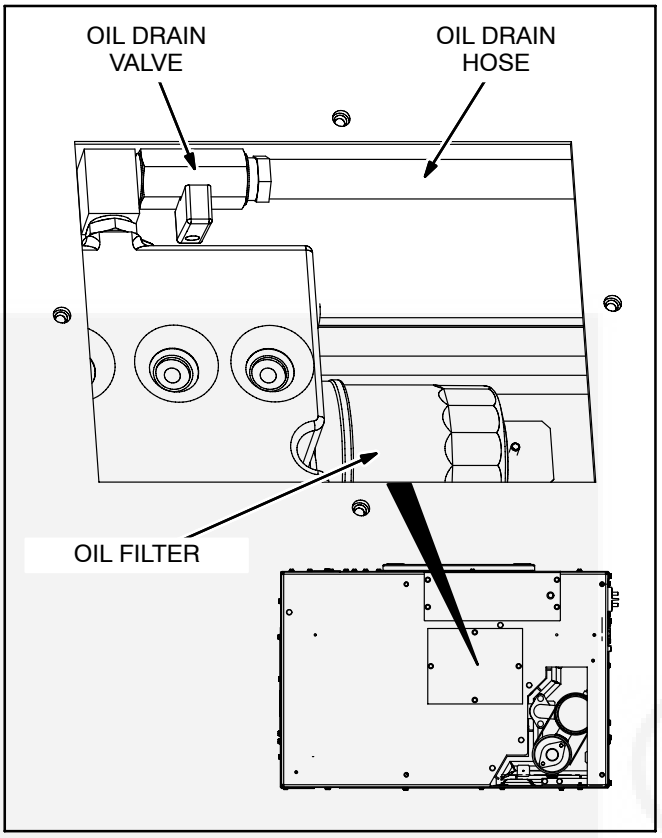

FIGURE 8. OIL DRAIN VALVE, DRAIN HOSE AND FILTER ACCESS THROUGH BOTTOM

MAINTAINING BATTERY AND BATTERY CONNECTIONS

Refer to Table 3 for scheduled battery maintenance, and follow the battery manufacturer's instructions. Have the battery charging system serviced if DC system voltage is consistently low or high. Always:

⚠WARNING ***Arcing at battery terminals or in light switches or other equipment, and flames or sparks, can ignite battery gas causing severe personal injury. To prevent injury:***

- ***Ventilate battery area before working on or near battery***
- ***Wear safety glasses***
- ***Do not smoke***
- ***Switch work light ON or OFF away from battery***
- ***Stop genset and disconnect charger before disconnecting battery cables***
- ***Disconnect negative (–) cable first and reconnect it last.***

1. Keep the battery case and terminals clean and dry and the terminals tight.
2. Remove battery cables with a battery terminal puller.
3. Make sure which terminal is positive (+) and which is negative (–) before making battery connections, always removing the negative (–) cable first and reconnecting it last to reduce arcing.

REPLACING AIR FILTER ELEMENT

Refer to Table 3 for scheduled air filter element replacement. In dusty environments the filter element should be inspected and changed more frequently.

⚠WARNING ***To prevent accidental or remote starting while working on the genset, disconnect the negative (–) battery cable at the battery.***

⚠WARNING ***Do not run the genset with the maintenance access covers off. Contact with hazardous moving parts and hot exhaust manifolds can cause severe personal injury.***

Remove the front access door, unscrew the 2 wingnuts on the filter housing and pull away the filter housing and filter element (Figure 9).

When installing the new filter element, turn the wingnuts hand tight.

Secure the maintenance access covers for proper engine cooling and for protection from hazardous moving parts and hot exhaust manifolds.

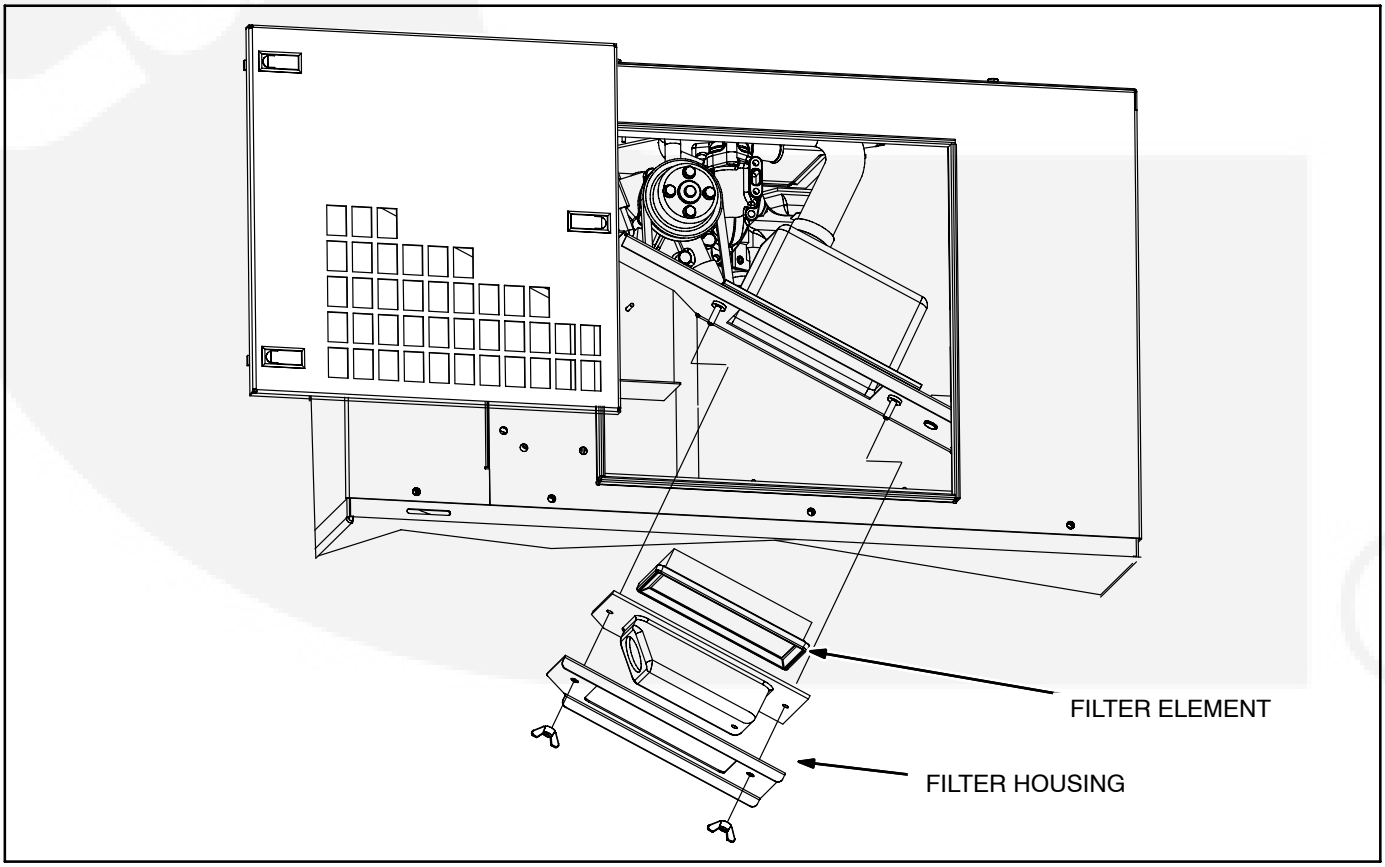

FIGURE 9. REPLACING THE AIR FILTER ELEMENT

REPLACING FUEL FILTER

See Table 3 for scheduled fuel filter replacement. A dirty fuel filter may be the cause of a failure to start. The fuel filter is accessible through the bottom access opening (Figure 10).

⚠WARNING ***Diesel fuel is combustible and can cause severe personal injury or death. Do not smoke near diesel fuel tanks or equipment. Keep flames, sparks, pilot lights, electrical switches, arc-producing equipment and all other sources of ignition well away. Keep a type ABC fire extinguisher in the vehicle.***

⚠WARNING ***To prevent accidental or remote starting while working on the genset, disconnect the negative (–) battery cable at the battery.***

⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

⚠WARNING ***Do not run the genset with the maintenance access covers off. Contact with hazardous moving parts and hot exhaust manifolds can cause severe personal injury.***

Removing the Fuel Filter

Take care to spill as little fuel as possible when disconnecting the filter from the fuel line. Close any shut off valve in the fuel line. Use paper towels to clean the two fuel line fittings and absorb any fuel that spills.

To remove the filter, disconnect the two fittings at the filter. *Use two flarenut wrenches on each fitting so as not to round the corners or stress the fittings.* Then remove the filter mounting nut and two (2) bracket mounting screws. Dispose of the fuel filter and paper towels according to local regulations.

Installing the Fuel Filter

Secure the bracket loosely to the new filter. The filter and its bracket fit properly only one way.

Loosely secure the filter and bracket to the base with the two mounting screws and re-connect the fuel fittings. Take care not to cross thread the fuel fittings. Thread them in by hand and tighten one flat past seating. Finally, tighten the bracket and bracket mounting screws.

Prime the fuel system by holding the control switch down in its **Stop** position for at least 1 minute. Priming is necessary to fill the new filter with fuel.

Secure the maintenance access covers for proper engine cooling and for protection from hazardous moving parts and hot exhaust manifolds.

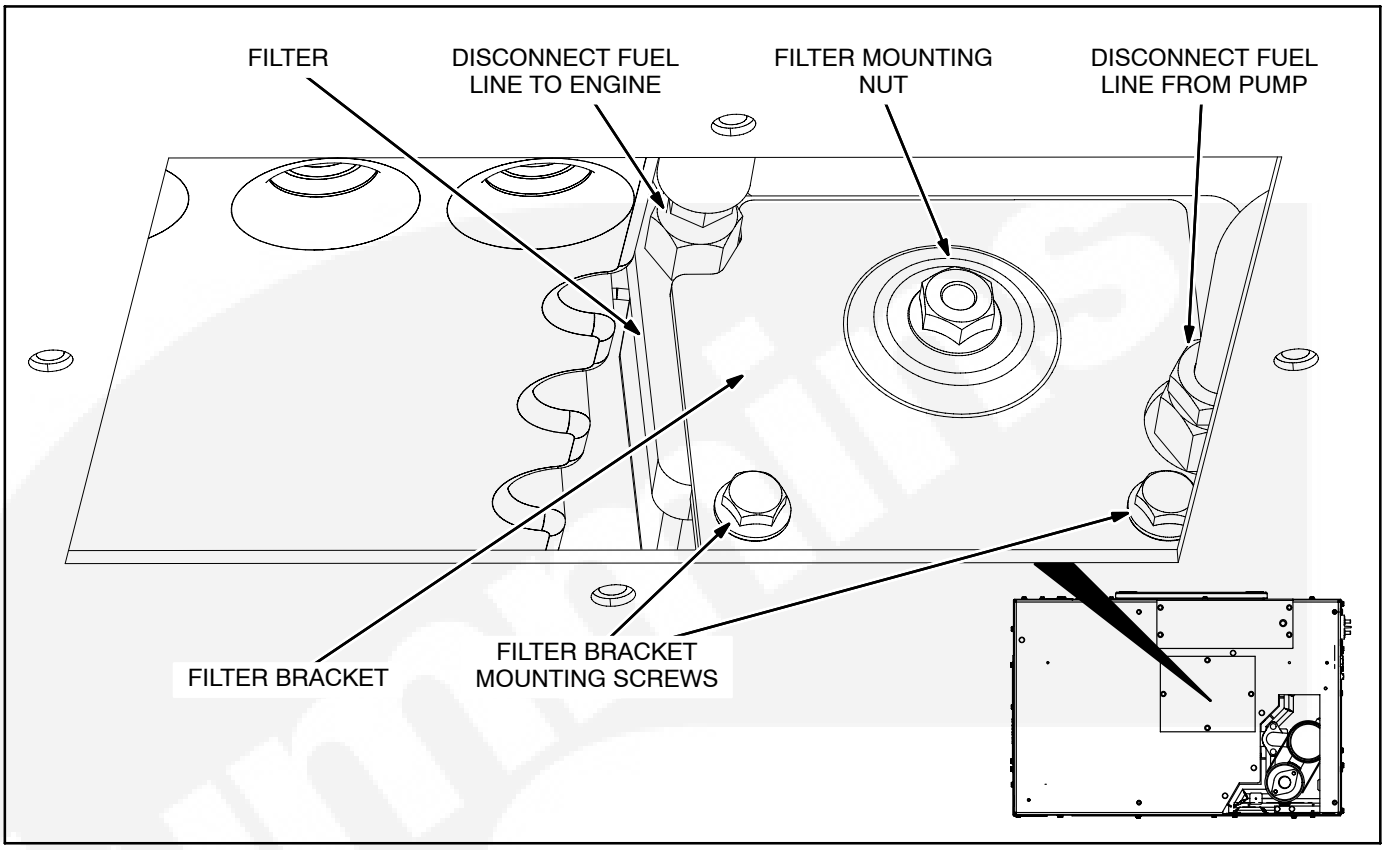

FIGURE 10. FUEL FILTER

CHANGING COOLANT

Refer to Table 3 for scheduled maintenance. The engine cooling system is filled with a 50/50 mixture of ethylene glycol and water at the factory, which is suitable for temperatures down to -34° F (-37° C).

Recommended Coolant Mixture

Use the best quality ethylene glycol antifreeze solution available. It should be fully formulated with rust inhibitors and coolant stabilizers. Use fresh water that is low in minerals and corrosive chemicals. Distilled water is best.

⚠WARNING ***Hot coolant spray can cause severe burns. Let the engine cool before releasing the pressure cap or opening the drain cock.***

Replacing the Pressure Cap

Replace the pressure cap (Figure 12) every two years (seals deteriorate and leak). Proper cooling system pressure (14 psi) is essential for optimal engine cooling and minimal coolant loss.

Draining the Cooling System

⚠WARNING ***To prevent accidental or remote starting while working on the genset, disconnect the negative (–) battery cable at the battery.***

⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

Let the engine cool before removing the pressure cap. Relieve any remaining pressure by turning the pressure cap slowly, without pushing down. To remove the cap, push down and turn it the rest of the way. Then remove the bottom access cover (Figure 11), open the radiator drain cock and drain the coolant into a suitable container. Approximately 1.6 quarts (1.5 L) will drain.

⚠WARNING ***Ethylene glycol antifreeze is considered toxic. Dispose of it according to local regulations for hazardous substances.***

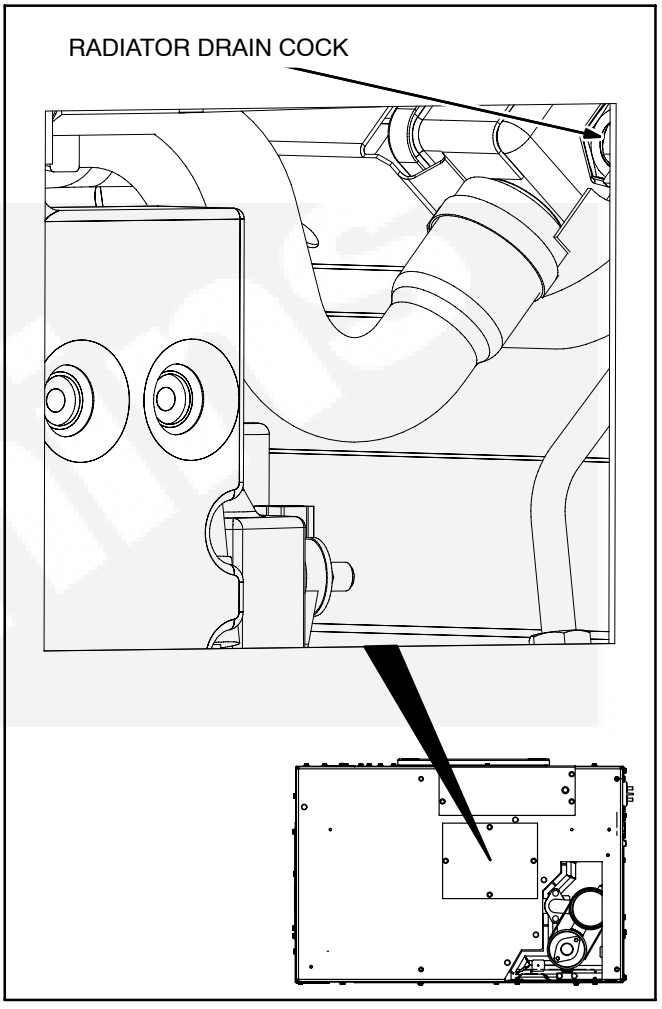

FIGURE 11. LOWER RADIATOR HOSE

Cleaning the Cooling System

Clean and flush the cooling system with radiator cleaning chemicals available at auto parts stores. Follow the instructions for cleaning and flushing that come with the cleaning solution.

Refilling the Cooling System

Close the radiator drain cock. Pull the hose connected to the pressure cap assembly out as far and as high as it will go (Figure 12). Remove the pressure cap and fill the system using a funnel inserted into the fill hose to prevent coolant from entering the vent hose and blocking the escape of air as the system fills. The system *will seem full when it actually is not* if the air cannot escape through the vent hose. If the vent hose does get blocked, pinch the overflow hose and blow the vent hose clear. Start and operate the genset for a few minutes while keeping the fill opening elevated to promote venting of air from the coolant. Shut down the genset and add coolant as necessary. Secure the pressure cap and fill the recovery tank to the COLD mark.

⚠CAUTION ***Coolant trapped in the vent hose will prevent the system from filling to its capacity, which can lead to serious engine damage.***

Secure the maintenance access covers for proper engine cooling and for protection from hazardous moving parts and hot exhaust manifolds.

⚠WARNING ***Do not run the genset with the maintenance access covers off. Contact with hazardous moving parts and hot exhaust manifolds can cause severe personal injury.***

Fill the recovery tank with coolant mixture to the COLD mark.

Checking Coolant Level

Check coolant level in the recovery tank (Figure 12) before the first startup of each day and fill to the COLD mark if necessary.

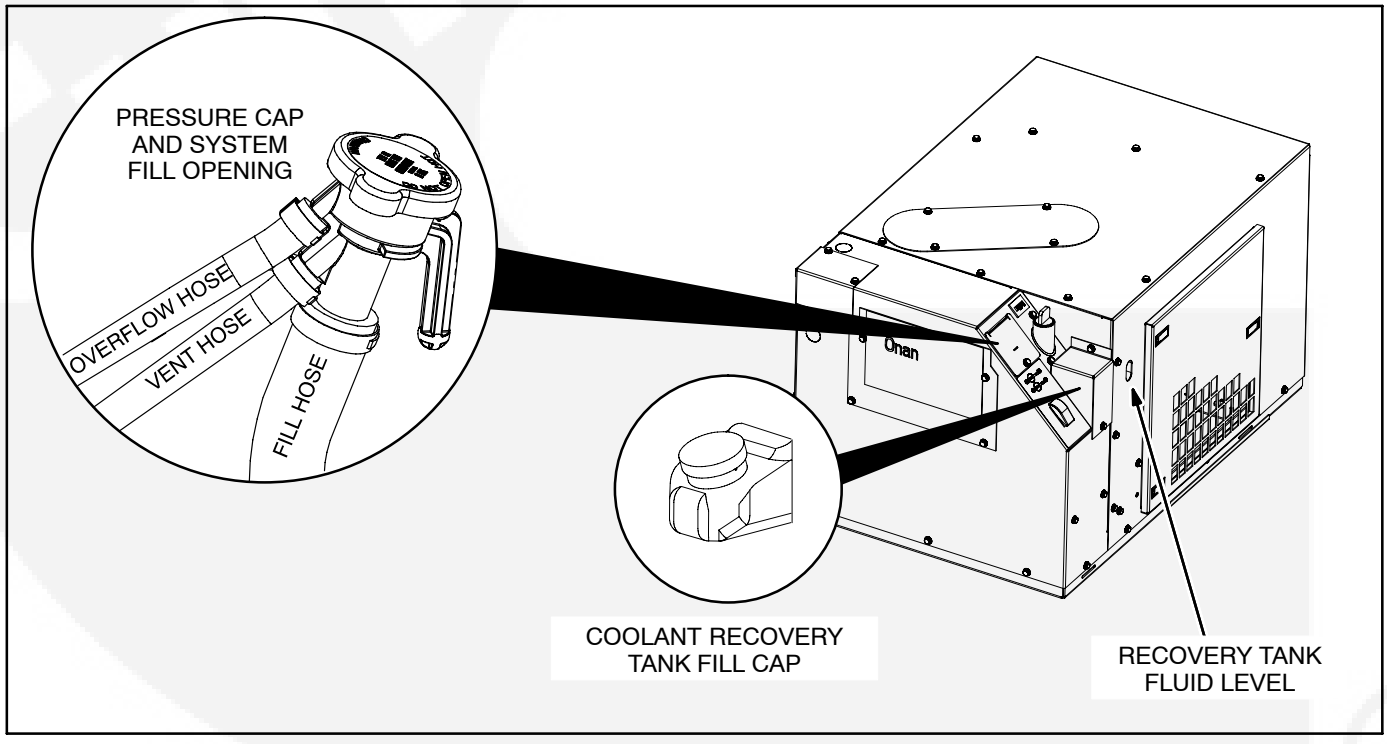

FIGURE 12. ENGINE COOLING SYSTEM PRESSURE CAP AND RECOVERY TANK

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4.Troubleshooting

TABLE 4. TROUBLESHOOTING lists the shutdown codes in numerical order along with step-by-step corrective actions. If you are unable to resolve the problem after taking the corrective actions suggested, contact an authorized Cummins Onan dealer. See *How to Obtain Service* (Page 40).

First note the following:

- Maintaining engine oil and coolant levels, keeping battery connections clean and tight, watching the fuel gauge, not overloading the genset, keeping the air inlet and outlet openings clear, etc. will prevent most shutdowns.
- When the genset and vehicle engine share a common fuel tank the fuel dip tubes are usually arranged so that the genset will run out of fuel first. Marking the genset empty point on the fuel gauge will make it easier to tell when to stop the genset before running it out of fuel.

SHUTDOWN CODES

The genset controller provides extensive diagnostics by causing the status indicator light on the Control Switch to blink in a coded fashion. Following a fault shutdown, the indicator light will repeatedly blink 1, 2, 3 or 4 blinks at a time.

- **One blink** indicates shut down due to high temperature.
- **Two blinks** indicate shutdown due to a loss of engine oil pressure.
- **Three blinks** indicate a service fault. Press **Stop** once to cause the two-digit, second-level shutdown code to blink. (Pressing **Stop** again will stop the blinking.) The two-digit code consists of 1, 2, 3, 4 or 5 blinks, a brief pause, and then 1 to 9 blinks. The first set of blinks represents the tens digit and the second set of blinks the units digit of the shutdown code number. For example, **shutdown code No. 36** appears as:

  blink-blink-blink—*pause*—blink-blink-blink-blink-blink-blink—*long pause*—repeat

- **Four blinks** indicate that cranking exceeded a preset time (20 seconds if ambient temperature is above 32° F[0° C], 30 seconds if below) without starting.
- **Note: shutdown code Nos. 3 and 4 are first level faults. Avoid interpreting them as second-level shutdown code Nos. 33 and 44, which have not been assigned as shutdown codes.**

Restoring Shutdown Code Blinking – The shutdown code stops blinking after five minutes. Press **Stop** three times within three seconds to restore blinking. ***Note that the last fault logged will blink, even after the condition that caused the shutdown has been corrected.***

TABLE 4. TROUBLESHOOTING

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.***

NO RESPONSE—DEAD STATUS INDICATOR LIGHT

(Poor connections, faulty wiring or dead battery)

Corrective Action:

1. Try starting the genset at the operator's console if it does not start at the remote panel.
2. Clean and tighten the battery cable connections at the battery and at the genset.
3. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

THE STARTING BATTERIES DO NOT MAINTAIN A CHARGE

(The battery, battery connections or charging system are in marginal condition)

Corrective Action:

1. Clean and tighten the battery cable connections at the battery and at the genset.
2. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

THE STARTER ENGAGES AND DISENGAGES

(Cranking voltage dips below 6 volts because of low battery charge or poor connections)

Corrective Action:

1. Have the vehicle propulsion engine running while trying to start the genset. (The battery charging alternator may be able to maintain starting voltage high enough to get the genset started.)
2. Clean and tighten the battery cable connections at the battery and at the genset.
3. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

THERE IS NO POWER WHEN THE GENSET IS RUNNING

(A line circuit breaker is OFF, tripped or malfunctioning)

Corrective Action:

1. Reset or turn ON the line circuit breaker on the genset (Page 16).
2. Reset or turn ON any other circuit breaker in the power supply system.

THE GENSET WILL NOT STOP RUNNING (THE RUN LIGHT IS OFF)

(The governor mechanism is stuck or binding)

Corrective Action: Close the fuel supply valve, if provided, or squeeze off the fuel supply line and see an authorized Cummins Onan dealer.

TABLE 4. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.***

HIGH TEMPERATURE FAULT—CODE NO. 1

(First-level fault code—engine coolant temperature exceeded 230° F [110° C])

Corrective Action:

1. Check the engine coolant level and add coolant as necessary (Page 28).
2. Check for and remove any objects blocking the air inlet or outlet openings in the bottom and sides of the genset.
3. Flush the coolant system to remove coolant passage fouling (Page 27).

LOW OIL PRESSURE FAULT—CODE NO. 2

(First-level fault code—the low oil pressure cutoff switch is open)

Corrective Action:

1. Check the engine oil level and add oil as necessary (Page 22).
2. Drain the excess oil if the oil level is above the Full mark on the dipstick. (The oil will foam if the level is too high and result in possible loss of oil pressure.)

SERVICE CHECK—CODE NO. 3

(First-level fault code—a second-level fault occurred)

Corrective Action: Check the second-level fault code by momentarily pressing Stop. The second-level fault will be one of the following in this table.

OVERCRANK FAULT—CODE NO. 4

(First-level fault code—Cranking without starting exceeded 20 to 30 seconds, depending on ambient)

Corrective Action:

1. Check the fuel level and refill as necessary. (Note: The genset fuel pickup is probably higher than the vehicle engine fuel pickup.)
2. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute.
3. Check the engine air filter (Page 24) and remove any blockage.
4. Check for mechanical damage.
5. Replace the fuel filter (Page 26).

OVERVOLTAGE FAULT—CODE NO. 12

(The controller is not able to regulate to rated voltage)

Corrective Action: See an authorized Cummins Onan dealer.

TABLE 4. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.***

UNDERVOLTAGE FAULT—CODE NO. 13

(The controller is not able to regulate to rated voltage)

Corrective Action: Turn OFF the line circuit breaker on the operator's console. If the genset now runs, run it with fewer connected loads.

OVERFREQUENCY FAULT—CODE NO. 14

(The controller is not able to regulate to rated frequency)

Corrective Action:

1. Check for a tripped genset circuit breaker, reset it if necessary, and run with fewer connected loads. (A breaker tripping under load can cause frequency to overshoot.)
2. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute. (Air bubbles can disrupt frequency.)

UNDERFREQUENCY FAULT—CODE NO. 15

(The controller is not able to regulate to rated frequency)

Corrective Action:

1. Turn OFF the line circuit breaker. If the genset now runs, run it with fewer connected loads, especially those with high motor starting loads such as air conditioners.
2. Check the fuel level and refill as necessary. (Note: The genset fuel pickup is probably higher than the vehicle engine fuel pickup.)
3. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute. (Air bubbles can disrupt frequency.)
4. Check the engine air filter (Page 24) and remove any blockage.
5. Check for mechanical damage.
6. Replace the fuel filter (Page 26).

GOVERNOR ACTUATOR FAULT—CODE NO. 19

(The controller sensed that the actuator circuit is either open or shorted)

Corrective Action: See an authorized Cummins Onan dealer.

TABLE 4. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.***

GOVERNOR OVERLOAD FAULT—CODE NO. 22

(The duration of operation at or near full-duty cycle was beyond the design limit)

Corrective Action:

1. Reduce the number of appliances running at the same time, especially those with high motor starting loads such as air conditioners.
2. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute.
3. Replace the engine air filter (Page 24) .
4. Replace the fuel filter (Page 26).

TEMPERATURE SENDER FAULT—CODE NO. 24

(The controller sensed that the sender circuit is either open or shorted)

Corrective Action: See an authorized Cummins Onan dealer.

AC VOLTAGE SENSE FAULT—CODE NO. 27

(The controller was unable to sense output voltage)

Corrective Action: See an authorized Cummins Onan dealer.

HIGH BATTERY VOLTAGE FAULT—CODE NO. 29

(The controller sensed battery system voltage greater than 19 volts)

Corrective Action:

1. Check battery bank connections and reconnect, if necessary, so that the 12 volt batteries serving the genset are connected in parallel (12 volt) rather than in series (24 volt).
2. Select a lower battery booster charge rate.

LOW CRANKING SPEED FAULT—CODE NO. 32

(Cranking speed less than 100 rpm [2.5 Hz, generator] for more than 12 seconds)

Corrective Action:

1. Have the vehicle propulsion engine running while trying to start the genset. (The battery charging alternator may be able to maintain starting voltage high enough to get the genset started.)
2. Clean and tighten the battery cable connections at the battery and at the genset.
3. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.
4. Replace engine oil with oil of proper viscosity for ambient temperatures. (High oil viscosity can slow down cranking speed.)

TABLE 4. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.***

CONTROL CARD FAULT—CODE NO. 35

(Microprocessor EEPROM error during self-test)

Corrective Action: See an authorized Cummins Onan dealer.

ENGINE STOPPED FAULT—CODE NO. 36

(The genset stopped without a command from the controller)

Corrective Action:

1. Check the fuel level and refill as necessary. (Note: The genset fuel pickup is probably higher than the vehicle engine fuel pickup.)
2. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute.
3. Check the engine air filter (Page 24) and remove any blockage.
4. Check for mechanical damage.
5. Replace the fuel filter (Page 26).

FIELD OVERLOAD FAULT—CODE NO. 38

(Field voltage exceeded 150 VDC)

Corrective Action:

1. Reduce the number of air conditioners running at the same time (and other appliances that cause low power factor).
2. Have the air conditioners and other appliances checked for proper operation. (A locked compressor rotor can cause very low power factor.)

SHORTED ROTOR FAULT—CODE NO. 41

(The rotor circuit is shorted to ground)

Corrective Action: See an authorized Cummins Onan dealer.

PROCESSOR FAULT—CODE NO. 42

(Microprocessor ROM error during self-test)

Corrective Action: See an authorized Cummins Onan dealer.

PROCESSOR FAULT—CODE NO. 43

(Microprocessor RAM error during self-test)

Corrective Action: See an authorized Cummins Onan dealer.

TABLE 4. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.***
SPEED SENSE FAULT—CODE NO. 45 (Controller unable to sense quadrature frequency) **Corrective Action:** Check the fuel level and fill as necessary. Then prime the engine fuel system by holding the control switch at **Stop** for one minute and try restarting.
OVERPRIME FAULT—CODE NO. 57 (Prime mode exceeded 3 minutes) **Corrective Action:** Check for and remove any object that may be holding either control switch (remote or local) in the prime (stop) position.

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5.Specifications

	HDKBB	HDKBC
GENSET CONTROLLER: Integrated Microprocessor Based Engine and Generator Controller		
GENERATOR: Two-Bearing, Two-Pole Rotating Field, “Poly-Vee” Belt Drive		
Power (@1.0 PF)	4800 W	5000 W
RPM	3000	3600
Frequency	50 Hz	60 Hz
Voltage	230V 1-Ph	120V 1-Ph, 120/240V 1-Ph, or 120/240V 3-Ph
Current	21 A	41.7/20.8 A or 12 A (3-Ph)
Circuit Breakers	2-pole 25 A (1 pole used)	2-pole 25 A (1-Ph) or 3-pole 15 A (3-Ph)
FUEL CONSUMPTION:		
No-load Half-load Full-load	0.20 gph (0.74 lph) 0.32 gph (1.23 lph) 0.54 gph (2.04 lph)	0.25 gph (0.95 lph) 0.39 gph (1.47 lph) 0.60 gph (2.27 lph)
ENGINE: 2-Cylinder In-Line, Water-Cooled, Indirect-Injection, 4-Stroke Cycle Diesel		
RPM	2880	2880
Bore	2.64 in (67 mm)	2.64 in (67 mm)
Stroke	2.68 in (68 mm)	2.68 in (68 mm)
Displacement	29.23 in^3 (479 cc)	29.23 in^3 (479 cc)
Compression Ratio	23 : 1	23 : 1
Injection Order	1–2	1–2
Engine Timing	18.25° to 19.75° BTDC	18.25° to 19.75° BTDC
Fuel Nozzle Injection Pressure	1991 psi (13.73 mPa)	1991 psi (13.73 mPa)
Valve Lash: Intake & Exhaust (cold)	0.0057 – 0.0073 inch (0.145 – 0.185 mm)	0.0057 – 0.0073 inch (0.145 – 0.185 mm)
Oil Capacity (with filter)	2 quart (1.9 liter)	2 quart (1.9 liter)
Cooling System Capacity	3.0 quart (2.8 liter)	3.0 quart (2.8 liter)
DC SYSTEM:		
Nominal Battery Voltage	12 volts	12 volts
Minimum Battery Capacity CCA (Cold Cranking Amps)	475 amps down to 0° F (–17° C) 650 amps down to –20° F (–29° C)	475 amps down to 0° F (–17° C) 650 amps down to –20° F (–29° C)
Fuse F1 (control, start and glow plug circuits)	30 amp mini-bayonet	30 amp mini-bayonet
WEIGHT: 400 lbs (181 kg)		
SIZE (L x W x H): 34.5 x 22.9 x 20.3 in (876 x 581.2 x 514.4 mm)		
SOUND LEVEL: 68 dB(A) @ 10 ft (3m) before installation and @ 1/2-load		

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6.How to Obtain Service

When you call for service, parts, or product literature (such as the Service Manual or Parts Catalog) for your genset, contact the nearest authorized Cummins Onan distributor. Cummins Onan has factory-trained representatives to handle your requests for genset parts and service. For information for contacting our distributors worldwide, go to internet site ***www.cumminsonan.com***.

In North America

Call 1-800-888-6626 to contact the nearest Cummins Onan distributor in the United States or Canada. (This automated service utilizes touch-tone phones only). Select OPTION 1 (press 1) to be automatically connected to the distributor nearest to you.

If you are unable to contact a distributor using the automated service, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS – ELECTRIC,
ENGINES – GASOLINE OR DIESEL, or
RECREATIONAL VEHICLES – EQUIPMENT, PARTS AND SERVICE.

If you have difficulty in arranging service or resolving a problem, please contact the Service Manager at the nearest Cummins Onan distributor for assistance.

Outside North America

If you are outside North America, call Cummins Onan at 1–763–574–5000 from 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday, or fax 1–763–528–7229.

Information to Have Ready

Before calling for service, have the following information available:

1. *The complete genset model number and serial number. See Model Identification (Page 4).*
2. *The date of purchase*
3. *The nature of the problem. See Troubleshooting (Page 30).*

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7.Maintenance Record

Record all periodic and unscheduled maintenance and service. See *Periodic Maintenance* (Page 20).

DATE	HOUR METER READING	MAINTENANCE OR SERVICE PERFORMED

Record the name, address, and phone number of your authorized Cummins Onan service center.

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